Claims

1. Method for the production of a MUC1 molecule which is able to generate an immune response in humans, comprising:
   (a) contacting a mixture of MUC1 molecules with an antibody having the following properties:
      (i) binding to the immunodominant region of the MUC1 tandem repeat; and
      (ii) the binding to a MUC1 fragment which has a length of between 9 and 40 amino acids and which contains sequences of the MUC1 tandem repeat and the immunodominant region is made possible or increased by glycosylation of the threonine of a PDTR sequence; and
      (iii) the binding of an unglycosylated MUC1 tandem repeat is increased if the unglycosylated MUC1 tandem repeats are present in series; and
      (iv) the binding to multiple glycosylated MUC1 tandem repeats which carry glycosylations at the threonines of several PDTR sequences of the immunodominant region is increased according to an additive effect from the length and the PDTR glycosylation vis-à-vis the short MUC1 fragments from ii);

   for a period of time which is sufficient and under conditions which are suitable so that an immune complex is formed;
   (b) isolation of the immune complex; and
   (c) providing the MUC1 molecule from the immune complex.

2. Method for the identification of a MUC1 molecule which is able to generate an immune response in humans, comprising:
   (a) contacting a mixture of MUC1 molecules with an antibody having the following properties:
      (i) binding to the immunodominant region of the MUC1 tandem repeat; and
      (ii) the binding to a MUC1 fragment which has a length of between 9 and 40 amino acids and which contains sequences of the MUC1 tandem repeat and the immunodominant region is made possible or increased by glycosylation of the threonine of a PDTR sequence; and

(iii) the binding of an unglycosylated MUC1 tandem repeat is increased if the unglycosylated MUC1 tandem repeats are present in series; and

(iv) the binding to multiple glycosylated MUC1 tandem repeats which carry glycosylations at the threonines of several PDTR sequences of the immunodominant region is increased according to an additive effect from the length and the PDTR glycosylation vis-à-vis the short MUC1 fragments from ii);

for a period of time which is sufficient and under conditions which are suitable so that an immune complex is formed;

(b) isolation of the immune complex.

3. Method according to claim 1 or 2, moreover comprising at least one of the following steps:

1) recovering the MUC1 molecule or the mixture thereof in step (a) of the method according to claim 1 or 2 from tumour tissue(s), tumour cells and/or body fluids containing tumour associated MUC1 molecules having been isolated previously;

2) recovering of the MUC1 molecule or of the mixture thereof in step (a) of the method according to claim 1 or 2 from cells or cell lines which express and/or secrete tumour associated MUC1 molecules or mixtures thereof;

3) recovering the MUC1 molecule or the mixture thereof in step (a) of the method according to claim 1 or 2 from recombinant cells or cell lines which have previously been genetically modified in such a manner that they express and/or secrete tumour associated MUC1 molecules or mixtures thereof;

4) recovering the MUC1 molecule or of the mixture thereof in step (a) of the method according to claim 1 or 2 from cell lysates and/or the cellular supernatant from tumour tissues, tumour cells and/or body fluids as described under (1) or from cells or cell lines as described under (2) and (3) which contain tumour associated MUC1.

4. Method for producing cells comprising a MUC1 molecule which is able to generate an immune response in humans, comprising:

(a) contacting a mixture of cells comprising MUC1 molecules with an antibody having the following properties:

(i) binding to the immunodominant region of the MUC1 tandem repeat; and

(ii) the binding to a MUC1 fragment which has a length of between 9 and 40 amino acids and which contains sequences of the MUC1 tandem repeat and the immunodominant region is made possible or increased by glycosylation of the threonine of a PDTR sequence; and

(iii) the binding of an unglycosylated MUC1 tandem repeat is increased if the unglycosylated MUC1 tandem repeats are present in series; and

(iv) the binding to multiple glycosylated MUC1 tandem repeats which carry glycosylations at the threonines of several PDTR sequences of the immunodominant region is increased according to an additive effect from the length and the PDTR glycosylation vis-à-vis the short MUC1 fragments from ii);

for a period of time which is sufficient and under conditions which are suitable so that an immune complex is formed;

(b) isolation of the cells which have formed an immune complex; and

(c) providing the cells from the immune complex.

5. Method for identifying cells comprising a MUC1 molecule which is able to generate an immune response in humans comprising:

(a) contacting a mixture of MUC1 molecules with an antibody having the following properties:

(i) binding to the immunodominant region of the MUC1 tandem repeat; and

(ii) the binding to a MUC1 fragment which has a length of between 9 and 40 amino acids and which contains sequences of the MUC1 tandem repeat and the immunodominant region is made possible or increased by glycosylation of the threonine of a PDTR sequence; and

(iii) the binding of an unglycosylated MUC1 tandem repeat is increased if the unglycosylated MUC1 tandem repeats are present in series; and

(iv) the binding to multiple glycosylated MUC1 tandem repeats which carry glycosylations at the threonines of several PDTR sequences of the immunodominant region is increased

according to an additive effect from the length and the PDTR glycosylation vis-à-vis the short MUC1 fragments from ii);

for a period of time which is sufficient and under conditions which are suitable so that an immune complex is formed;

(b) identification of the immune complex.

6. Method according to claim 4 or 5 moreover comprising at least one of the following steps:

1) recovering cells, cell lines or sub-cell lines which carry and/or secrete tumour associated MUC1 molecules or mixtures thereof in step (a) of the method according to claim 4 or 5 from tumour tissue or tumour cells which contain tumour associated MUC1 molecules which have previously been isolated with or without subsequent cell cloning;

2) recovering cells, cell lines or sub-cell lines which carry and/or secrete tumour associated MUC1 molecules or mixtures thereof in step (a) of the method according to claim 4 or 5 from cells or cell lines which contain tumour associated MUC1 molecules with or without subsequent cell cloning;

3) recovering cells, cell lines or sub-cell lines which carry and/or secrete tumour associated MUC1 molecules or mixtures thereof in step (a) of the method according to claim 4 or 5 from recombinant cells or cell lines which have previously been genetically modified in such a manner that they express and/or secrete tumour associated MUC1 molecules or mixtures thereof with or without subsequent cell cloning;

4) recovering cells, cell lines or sub-cell lines which carry and/or secrete tumour associated MUC1 molecules or mixtures thereof in step (a) of the method according to claim 4 or 5 which have been genetically modified in such a manner that they carry and/or secrete immunostimulating molecules with or without subsequent cell cloning;

5) recovering cell lysates or mixtures of cell lysates from cells, cell lines or sub-cell lines as described under (1) to (4) which contain tumour associated MUC1.

7. Method according to any one of claims 1 to 6 wherein the antibody is selected from the group consisting of A76-A/C7, VU-11E2, VU-11D1, BC4E549, VU-12E1, VU-3D1 and b-12.

8. Method for producing an antibody comprising:
   a) carrying out the steps of the method according to any one of claims 1 to 7;
   b) introducing the MUC1 molecule of the cell or the cell lysate into an animal; and
   c) providing an antibody which specifically recognises the MUC1 molecule and exhibits a particularly strong additive effect.

9. Method for producing a pharmaceutical composition comprising the steps of the method of any one of claims 1 to 8 and furthermore comprising the step of formulating the MUC1 molecule, the cell, the cell lysates or the antibody in a pharmaceutically acceptable form.

10. Method for producing a pharmaceutical composition comprising the steps of the method according to claims 1 to 8 and furthermore comprising the step of formulating the MUC1 molecule, the cell, the cell lysate or the antibody in a diagnostically applicable form.

11. Use of a MUC1 molecule obtainable by a method according to any one of claims 1 to 3 or 7, or a cell or a cell lysate obtainable by a method according to any one of claims 4 to 7 or of the antibody obtainable by the method according to claim 8 for producing a pharmaceutical composition for the treatment or prevention of tumours.

12. Use of an antibody obtainable by the method according to claim 8 for producing a diagnostic agent for the diagnosis of tumours and/or the production of a therapeutic agent for the therapy or prophylaxis of tumour diseases.

13. Purified MUC1 molecule which has an immunostimulating effect in humans and is obtainable by a method according to any one of claims 1 to 3 or 7.